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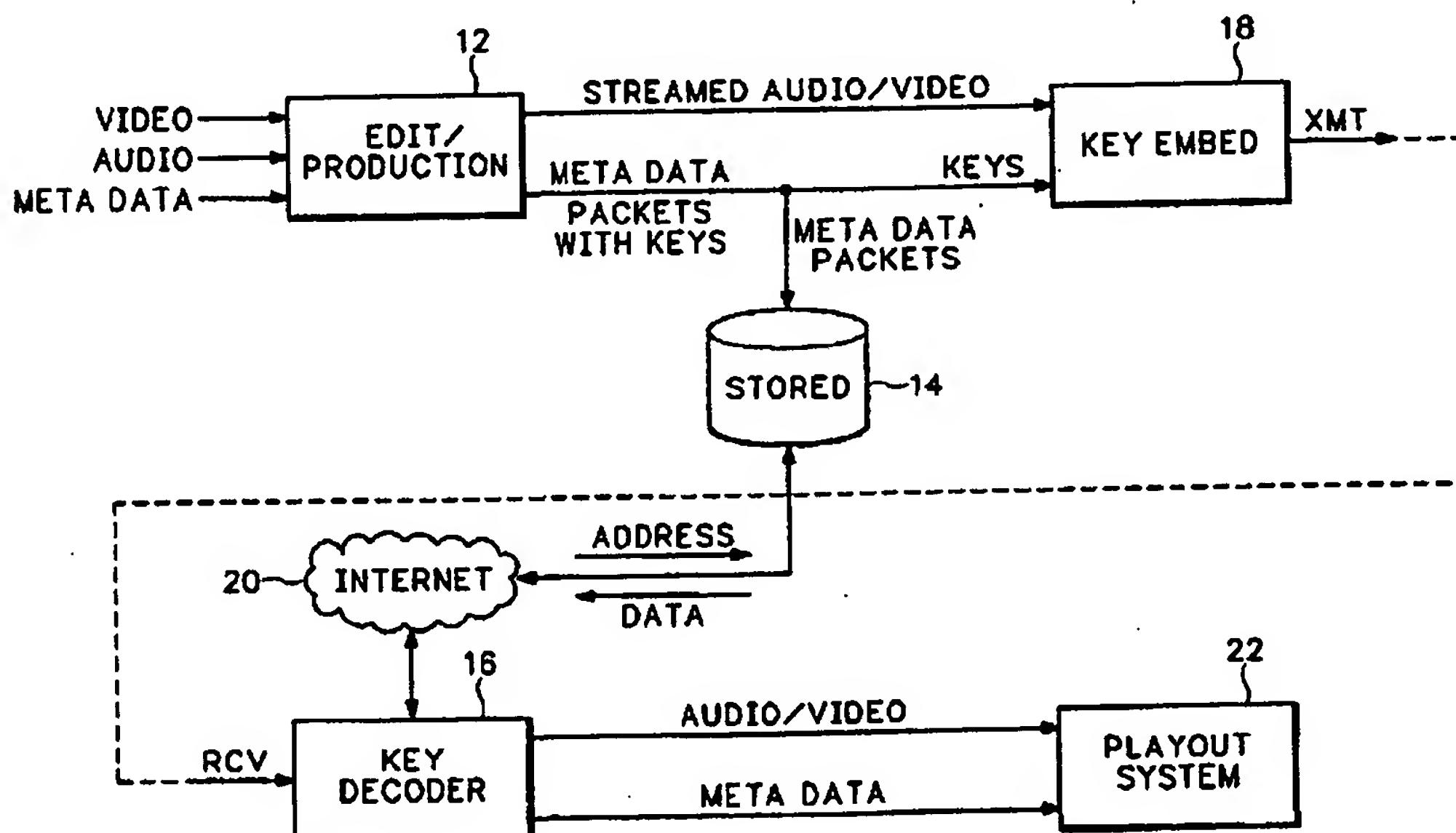
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(54) Subliminally embedded keys in video for synchronization

(57) A data file containing metadata and/or control data is synchronized with associated audio/video data by subliminally embedding a key in a frame of the audio/video. The key indicates the location of the data file and a time after the embedded frame in which the data file is to be activated to be in synchronism with the audio/

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Description**BACKGROUND OF THE INVENTION**

[0001] The present invention relates to multimedia systems, and more particularly to a subliminally embedded key in a video signal for synchronization of playout control of multimedia data and/or of execution of instructions contained in control data.

[0002] Watermarking of video signals is becoming of increasing use as a means of transmitting very low rate data as part of the video signal. Watermarking of video has been proposed for performing audio to video delay compensation, for indicating authentication or program ownership and for verifying playing of a video signal such as in advertisement logging. The watermarking technique inserts the very low rate data into the active portion of the video signal so as to be invisible while still having the robustness to survive video signal processing including multiple generations of compression encoding/decoding. See U.S. Patent No. 4,969,041 issued to William O'Grady et al on November 6, 1990 entitled "Embedment of Data in a Video Signal" and co-pending U.S. Patent Application Serial No. 08/829,524 by Daniel Baker et al filed on March 28, 1997 entitled "Transparent Embedment of Data in a Video Signal".

[0003] Also the use of auxiliary channels for transmitting data related to video signals is known, as shown in U.S. Patent No. 6,075,561 issued to Bozidar Janko on June 13, 2000 entitled "Low Duty-Cycle Transport of Video Reference Images". With the advent of the Internet, proposals have been made to use the Internet as the auxiliary channel for transporting data. It is anticipated that when video that is streamed over the Internet is played out, it may be desirable to also play out other data — called metadata — that is associated with the video to immerse the viewer in the experience. It may also be desirable to transmit control data to the equipment receiving the video. This control data may be used for one or more of the following purposes: (1) cue a commercial; (2) specify a destination to which the video is to be routed; (3) control auxiliary equipment to actuate other sensory cues such as activation of special lighting or sound effects; (4) control the parameters for compressing the video prior to storage; etc.

[0004] However transmitting the metadata is not currently possible using watermarking technology with video. The bit rate of the metadata, such as 9600 baud, is too high for the very low data rate channel afforded by watermarking. Transmission of control data may or may not be possible using watermarking technology directly, depending upon the quantity of data which varies with the application.

[0005] The problem that arises is how to synchronize the metadata or other control data with the video when they are transmitted over different channels so that the metadata appears at the proper point with relationship to the video when seen by the viewer, or the control data

is retrieved and used at the proper point with relationship to the video.

[0006] What is desired is a means for synchronizing the metadata or control data with the associated video when the video is played out.

BRIEF SUMMARY OF THE INVENTION

[0007] Accordingly the present invention provides subliminally embedded keys in video that act as pointers and synchronizing signals for a data file containing metadata and/or control data so that the metadata is displayed with the video and/or instructions contained in the control data are executed at the proper time. At the transmission end of a system a key is generated in synchronization with the video, the key being associated with corresponding data file. The key is embedded subliminally in the video at an appropriate point using watermarking techniques. At a receiver the key is decoded from the video and used to access a network server that contains the data file. Once retrieved the metadata from the data file is displayed with the video at a point in synchronization with the video as indicated by the key, or the control data is used to perform one or more auxiliary functions at designated times. For small data files where the retrieval delay is small, the key may be just a few frames before the first video frame which is associated with the data file, while for large data files the key may be inserted several seconds before the first video frame which is associated with the data file. The key provides both an "address" for retrieving the data file and a time from the key frame when the metadata from the data file is to be played out with the video for a viewer or when the instructions contained in the control data are to be executed. In this way the data file is synchronized with the video.

[0008] The objects, advantages and other novel features of the present invention are apparent from the following detailed description when read in conjunction with the appended claims and attached drawing.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0009] The Figure is a block diagram view of a system for synchronizing a data file with video using subliminally embedded keys according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Referring now to the Figure video, audio and an associated data file containing metadata and/or control data is input to an edit/production system 12. The output from the edit/production system 12 is streamed audio/video and the data file with associated keys. The data file is stored in an appropriate storage device 14, such as a network server, and the keys are input with the streaming audio/video to a key embedment system

16 such as those described in U.S. Patent No. 4,969,041 and U.S. Patent Application Serial No. 08/829,524 referenced above. The keys have information that indicates the location of the associated data file in the storage medium 14 and a time in number of frames from the frame in which the key is embedded when the control instructions from the data file should be executed or the metadata should be played out to be in synchronism with the audio/video stream to account for latency in accessing the data file. Large data files require a longer access time, so the key is embedded in a frame much further ahead of the frame where the data file is to be used, whereas small data files may not require as much "lead" time.

[0011] The streaming audio/video with embedded keys is transmitted over a transmit channel to a receive site where a key decoder 18 extracts the keys from the streaming audio/video and accesses an alternate channel 20, such as the Internet. The information from the keys is transmitted over the alternate channel 20 to the storage medium 14 and the data file is transferred from the storage medium to a buffer in the key decoder 18. When the number of frames from the frame in which the key is embedded has passed, as indicated by the key, the metadata from the data file is played out with the streaming audio/video to a playout system 22 so as to be synchronized with the audio/video stream. Alternatively the instructions contained in the control data of the data file are executed. The playout system 22 may be a settop box for a consumer television set or multimedia computer where the viewer can control whether or not to view the metadata or only portions of the metadata. The playout system 22 may also be the device responsible for implementing the instructions contained in the control data.

[0012] Thus the present invention provides subliminally embedded keys in video for synchronization of a data file containing metadata and/or control data with associated audio/video streams, the data file being provided by an alternate channel and the keys having an address for the data file as well as a time when the metadata in the data file plays out with the audio/video streams or when the instructions in the control data are executed.

5 accessing the network storage medium according to the location indicated by the key; using the data file in synchronism with the audio/video data according to the latency time.

10 2. The method as recited in claim 1 wherein the data file comprises metadata to be played out in synchronism with the associated audio/video data and the using step comprises the step of playing out the metadata for display in synchronism with the audio/video data.

15 3. The method as recited in claim 1 wherein the data file comprises control data to be activated in synchronism with the associated audio/video data and the using step comprises the step of activating instructions contained in the control data for execution in synchronism with the audio/video data.

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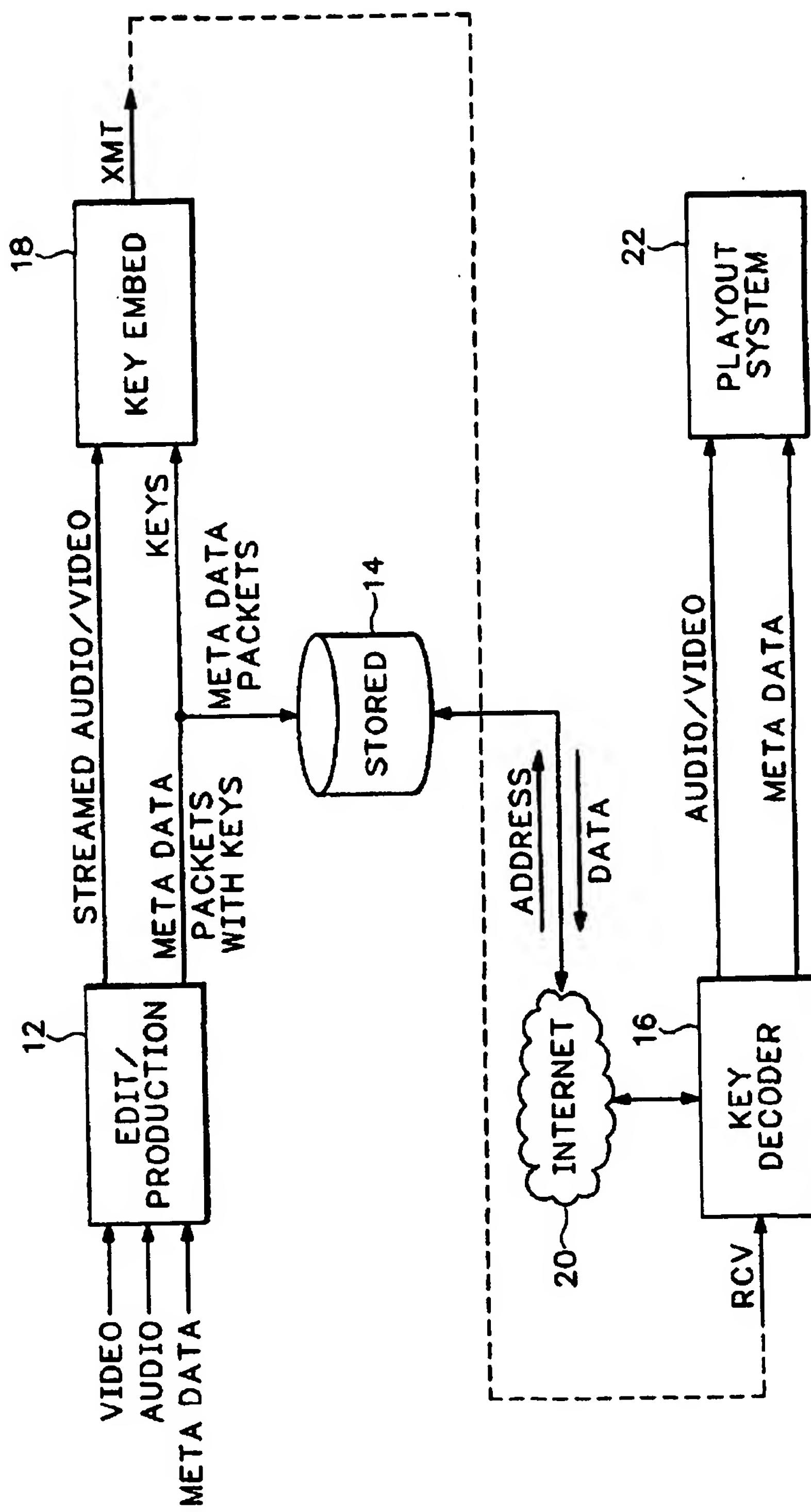
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Claims

1. A method of synchronizing a data file with associated audio/video data using subliminally embedded keys comprising the steps of:

at a transmit site embedding a key subliminally in the audio/video data, the key indicating a location of the data file on a network storage medium and a latency time;

at a receive site extracting the key from the audio/video data;



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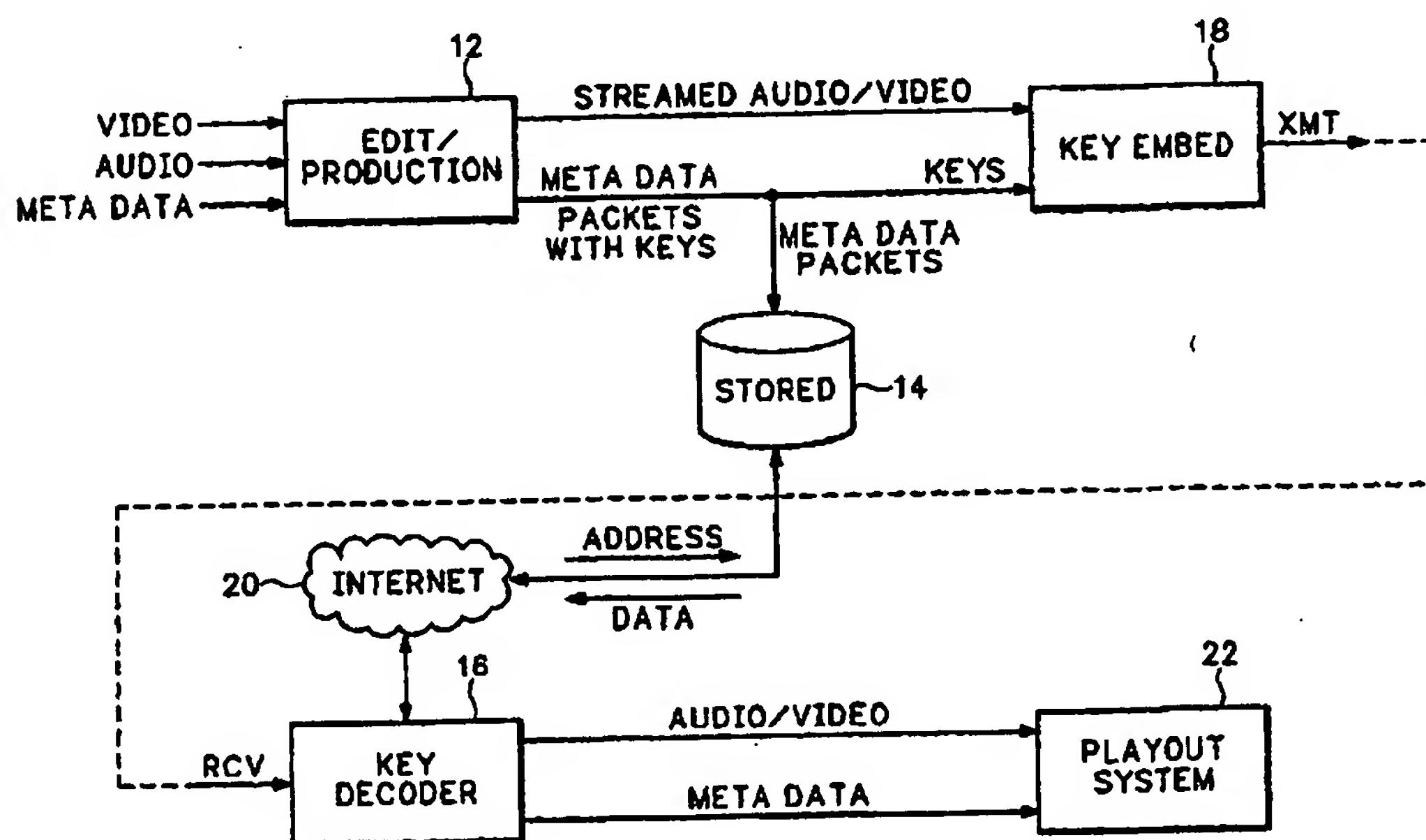
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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)		
X	US 5 774 664 A (HIDARY JACK D ET AL) 30 June 1998 (1998-06-30) * abstract * * column 3, line 25 - column 4, line 9 * * column 4, line 27-67 * * column 6, line 17 - column 6, line 25 * * column 7, line 7 - column 9, line 2 * ---	1,2	H04N7/24 H04N7/26		
X	EP 0 965 227 A (ACTV INC) 22 December 1999 (1999-12-22) * page 2, line 41-49 * * page 3, line 40-57 * * page 12, line 15-47 * * figures 1,6 *	1,2			
X	WO 00 45599 A (RAINSFORD PATRICK J ; EMUSE CORP (IE)) 3 August 2000 (2000-08-03) * abstract * * page 1, line 26 - page 2, line 11 * * page 4, line 34 - page 5, line 29 * * page 6, line 1-30 * * page 7, line 7-28 * * page 18, line 9 - page 19, line 23 * * page 20, line 2-13 * * page 21, line 1-11 * * figures 1,10,12 *	1-3			
A	US 6 122 403 A (RHOADS GEOFFREY B) 19 September 2000 (2000-09-19) * column 64, line 62 - column 68, line 67 * * figure 27 *	1-3 -/-	H04N		
The present search report has been drawn up for all claims					
Place of search	Date of completion of the search	Examiner			
THE HAGUE	14 April 2003	Marzal-Abarca, X			
CATEGORY OF CITED DOCUMENTS					
X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background C: non-written disclosure P: intermediate document					
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DOCUMENTS CONSIDERED TO BE RELEVANT									
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int'l Cl.)						
A	<p>WO 98 17064 A (WESTBERG THOMAS E ; KWOH DANIEL S (US); LEUNG ELSIE Y (US); MANKOVI) 23 April 1998 (1998-04-23)</p> <p>* page 2, line 27 - page 3, line 2 *</p> <p>* page 5, line 15 - page 5, line 22 *</p> <p>* page 11, line 24 - page 12, line 4 *</p> <p>---</p>	1-3							
A	<p>US 5 774 666 A (PORTUESI MICHAEL J) 30 June 1998 (1998-06-30)</p> <p>* abstract *</p> <p>* column 2, line 15 - column 3, line 35 *</p> <p>* column 5, line 32 - column 6, line 32 *</p> <p>* column 8, line 52 - column 9, line 44 *</p> <p>* figures 1-5 *</p> <p>* table 2 *</p> <p>-----</p>	1,2							
			TECHNICAL FIELDS SEARCHED (Int'l Cl.)						
<p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of completion of the search</td> <td style="width: 34%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>14 April 2003</td> <td>Marzal-Abarca, X</td> </tr> </table>				Place of search	Date of completion of the search	Examiner	THE HAGUE	14 April 2003	Marzal-Abarca, X
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THE HAGUE	14 April 2003	Marzal-Abarca, X							
<p>EPO FORM 1503 03/92 (postcon)</p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document</p>		<p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons S : member of the same patent family, corresponding document</p>							

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 01 30 8791

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-04-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5774664	A	30-06-1998	US 5778181 A AT 204110 T AU 2070597 A DE 69706036 D1 DE 69706036 T2 DK 885525 T3 EP 0885525 A1 EP 0982943 A2 ES 2159118 T3 WO 9733434 A1 US 2002049832 A1 US 2002042813 A1 US 6018768 A US 2002188699 A1 US 2003005151 A1 US 2003065719 A1 US 6513069 B1 US 6330595 B1 US 2001037376 A1 US 2002035614 A1 US 2002035615 A1 US 2002035600 A1 US 2002038344 A1 US 2002035601 A1	07-07-1998 15-08-2001 22-09-1997 13-09-2001 06-06-2002 08-10-2001 23-12-1998 01-03-2000 16-09-2001 12-09-1997 25-04-2002 11-04-2002 25-01-2000 12-12-2002 02-01-2003 03-04-2003 28-01-2003 11-12-2001 01-11-2001 21-03-2002 21-03-2002 21-03-2002 28-03-2002 21-03-2002
EP 0965227	A	22-12-1999	AT 213114 T AU 3370597 A BR 9714670 A DE 69710372 D1 DE 69710372 T2 DK 965227 T3 EP 0965227 A1 GB 2338388 A ,B HK 1024107 A1 JP 2002510439 T CN 1254471 A EP 1021038 A2 EP 1021036 A2 EP 1021037 A2 EP 1026897 A2 ES 2171958 T3 GB 2343095 A ,B GB 2348586 A ,B GB 2348346 A ,B GB 2348587 A ,B GB 2355135 A ,B	15-02-2002 29-09-1998 07-11-2000 21-03-2002 11-07-2002 13-05-2002 22-12-1999 15-12-1999 29-12-2000 02-04-2002 24-05-2000 19-07-2000 19-07-2000 19-07-2000 09-08-2000 16-09-2002 26-04-2000 04-10-2000 27-09-2000 04-10-2000 11-04-2001

EPO FORM P039
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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 01 30 8791

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EPO file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-04-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0965227 A		GB 2355136 A ,B GB 2355137 A ,B GB 2356767 A ,B GB 2356768 A ,B HK 1027700 A1 HK 1032310 A1 HK 1032311 A1 HK 1032312 A1 HK 1039235 A1 HK 1039236 A1 HK 1039708 A1 HK 1039709 A1 WO 9841020 A1 US 2002188943 A1	11-04-2001 11-04-2001 30-05-2001 30-05-2001 02-11-2001 08-03-2002 08-03-2002 08-03-2002 26-07-2002 26-07-2002 16-08-2002 09-08-2002 17-09-1998 12-12-2002
WO 0045599 A	03-08-2000	AT 230195 T AU 2125400 A CA 2361431 A1 DE 60001057 D1 DK 1157554 T3 EP 1157554 A2 WO 0045599 A2 JP 2002541684 T	15-01-2003 18-08-2000 03-08-2000 30-01-2003 17-02-2003 28-11-2001 03-08-2000 03-12-2002
US 6122403 A	19-09-2000	US 5862260 A US 5841978 A AU 3008697 A EP 1019868 A2 WO 9743736 A1 US 2002188841 A1 US 6229924 B1 US 6421070 B1 US 2003031341 A1 US 2003039377 A1 US 6408082 B1 US 6505160 B1 US 6424725 B1 US 2001055407 A1 US 2001017931 A1 US 2002090113 A1 US 2002136429 A1 US 2002164049 A1 US 2002186886 A1 US 2002186887 A1 US 2003012403 A1 US 2003021441 A1	19-01-1999 24-11-1998 05-12-1997 19-07-2000 20-11-1997 12-12-2002 08-05-2001 16-07-2002 13-02-2003 27-02-2003 18-06-2002 07-01-2003 23-07-2002 27-12-2001 30-08-2001 11-07-2002 26-09-2002 07-11-2002 12-12-2002 12-12-2002 16-01-2003 30-01-2003

EPO FORM P0506
For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 01 30 8791

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14-04-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6122403 A		US 2003033530 A1 US 2003053653 A1 US 2003053654 A1 US 6307949 B1 US 6381341 B1 US 2001031065 A1 US 2001022848 A1 US 2001019618 A1 US 2001016051 A1 US 2002009208 A1 US 2002006212 A1 US 2002067844 A1 US 2002118831 A1 US 2002076081 A1 US 2002090112 A1 US 2002080997 A1 AT 230539 T AT 216546 T AU 6022396 A CA 2218957 A1 DE 69620751 D1 DE 69620751 T2 DE 69625626 D1 EP 1003324 A2 EP 1049320 A1 EP 1137251 A2 EP 0824821 A2 JP 2002504272 T	13-02-2003 20-03-2003 20-03-2003 23-10-2001 30-04-2002 18-10-2001 20-09-2001 06-09-2001 23-08-2001 24-01-2002 17-01-2002 06-06-2002 29-08-2002 20-06-2002 11-07-2002 27-06-2002 15-01-2003 15-05-2002 29-11-1996 14-11-1996 23-05-2002 31-10-2002 06-02-2003 24-05-2000 02-11-2000 26-09-2001 25-02-1998 05-02-2002
WO 9817064 A	23-04-1998	AU 726960 B2 AU 4823197 A BR 9712352 A CN 1251723 A EP 0932979 A1 JP 2002515287 T KR 2000049237 A WO 9817064 A1	30-11-2000 11-05-1998 31-08-1999 26-04-2000 04-08-1999 21-05-2002 25-07-2000 23-04-1998
US 5774666 A	30-06-1998	US 5987509 A US 6499057 B1	16-11-1999 24-12-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82